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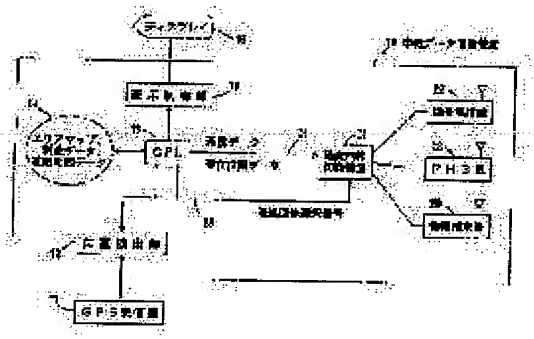
(54) ON-VEHICLE DATA COMMUNICATION EQUIPMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To attain communication employing a communication means offering the cheapest charging by storing a communication available for each area to an area map, retrieving the area map in response to a current position of a vehicle detected at the start of communication and selecting a communication means thereby attaining stable communication at all times.
SOLUTION: This on-vehicle data communication equipment 10 gives a signal of a GPS satellite to a position detection section 12 via a GPS receiver 11. A communication line changeover device 21 is connected to a CPU 13 via lines 24, 25, and the line 24 is used to deliver various data such as road map information and traffic information from an information center to the CPU 13. Current position data calculated by a position detection section 12 are given to the communication line changeover device 21 via the line 24. A CD-ROM 14 stores data of an area map, and charging data together with road map data. Any of three communication means as a portable telephone line, a PHS line and a satellite communication channel corresponding to a number of a resident area is selected by the data in the area map.



CLAIMS

[Claim(s)]

[Claim 1]Two or more means of communication which are the mounted data communication units for being carried in vehicles which have a position detecting means, and communicating a communication apparatus and various data of the vehicles exterior, and can communicate with a communication apparatus of the vehicles exterior, An area map memory measure which memorized a means of communication which can communicate for every field, A mounted data communication unit characterized by communicating various data using a means of communication with a selected selecting means including a selecting means which searches said area map memory measure and chooses a means of communication according to a current position of vehicles detected by a position detecting means at the time of a communication start.

[Claim 2]Two or more means of communication which are the mounted data communication units for being carried in vehicles and communicating a communication apparatus and various data of the vehicles exterior, and can communicate with a communication apparatus of the vehicles exterior, An account data memory measure which memorized information on the tariff structure of two or more of said means of communication, A data volume prediction means which predicts the amount of commo data when carrying out data communications, A mounted data communication unit characterized by communicating various data using a means of communication with a selected selecting means including a selecting means which searches said account data memory measure and chooses a means of communication with the cheapest fee according to data volume predicted by data volume prediction means at the time of a communication start.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the mounted data communication unit for transmitting and receiving various data between the information centers holding road map information, traffic information, etc.
[0002]
[Description of the Prior Art]From the former, in order to give facilities to a run of vehicles, the current position of vehicles is detected and the mounted navigation device which displayed this current position on the display with the road map of the circumference of it is known. In such a navigation device, the road map around a current position is usually stored in the road map memory which comprised a CD-ROM etc.
If needed, it is read from said road map memory, and is displayed.

[0003]However, in said navigation device, only the road map beforehand memorized by the road map memory cannot be displayed, and the road etc. which were newly opened for traffic cannot be displayed on a display. Although what is necessary is just to replace with CD-ROM by which the information on that road was taken in in order to display this road newly opened for traffic, since a certain amount of period is taken for the information on that road to be taken in by CD-ROM, the newest traffic information always cannot be displayed.
[0004]On the other hand, in a navigation device, if it enables it to display information, not only including the current position of vehicles, and the display of a road map but congestion information, an accident and construction information, road regulation information, a weather report, etc., it can be made a much more useful device. Then, between navigation devices, etc. information centers, etc. which were carried in vehicles is connected with a communication line like a cellular-phone circuit, and research and development of the system which provided road map information and said variety of information from the information center to the navigation device are furthered in recent years.
[0005]not only a navigation device but the navigation device which attached such a communication function in this specification, or the mounted device which can generally carry out data communications between vehicles and the exterior -- "a mounted data communication unit" -- or it is only called a "data communication unit." For example, to JP,4-266228,A. The currency information of the vehicles which the GPS (Global Positioning System) device detected is transmitted to an information center through a car telephone circuit, Road map information, road regulation information, etc. near [this] the current position are made to return from an information center, and the data communication unit displayed on the display is indicated. Since the information on the newest road map relevant to the position of vehicles, etc. can be acquired according to this device, it can respond to opening of traffic of a new road, change of traffic restriction, etc.
[0006]
[Problem(s) to be Solved by the Invention]By the way, transmission speed when a car telephone circuit and a cellular-phone circuit are used as a communication line which connects an information center and a data communication unit is a maximum of 9600 bps (bits per second). Therefore, with the data communication unit currently indicated by said publication before examination, when there is much amount of information received from an information center, data communications will take long time.
[0007]In order to solve such fault, it is possible to use the PHS (Personal Handy-phone System) circuit in which the data communications in a maximum of 32k bps are possible as a communication line, but. In a PHS circuit, the area (cell) which one PHS base station covers is as narrow as about radius abbreviation 50-100m, and many areas which cannot be covered in a PHS base station exist.
[0008]The fee collection system (telex rate gold per time) of the means of communication of a cellular phone, PHS, etc. is also various, and it is decided by balance with the data volume which is going to transmit whether a fee will become the cheapest if which means of communication is used. Then, the purpose of this invention is to provide the mounted data communication unit which can perform efficiently data communications with the information center holding road map information, traffic information, etc. through the optimal means of communication.
[0009]
[Means for Solving the Problem]A mounted data communication unit of this invention for attaining the aforementioned purpose, Two or more means of communication which can communicate with a communication apparatus of the vehicles exterior, and an area map memory measure which memorized a means of communication which can communicate for every field, Various data is communicated using a means of communication with a selecting means selected including a selecting means which searches said area map memory measure and chooses a means of communication according to a current position of vehicles detected

by a position detecting means at the time of a communication start (claim 1).
[0010]Since according to the composition according to claim 1 a means of communication which makes the area concerned a communication feasible region among two or more means of communication is chosen by selecting means according to a position of detected vehicles while moving in a certain area, always stable communication can be carried out. Two or more means of communication in which this invention can communicate with a communication apparatus of the vehicles exterior, An account data memory measure which memorized information on the tariff structure of two or more of said means of communication, A data volume prediction means which predicts the amount of commo data when carrying out data communications, Various data is communicated using a means of communication with a selecting means selected including a selecting means which searches said account data memory measure and chooses a means of communication with the cheapest fee according to data volume predicted by data volume prediction means at the time of a communication start (claim 2).
[0011]According to the composition according to claim 2, when it is going to carry out data communications among two or more means of communication, it can communicate by using a means of communication with the cheapest fee.
[0012]
[Embodiment of the Invention]Below, the embodiment of this invention is described in detail with reference to an accompanying drawing. Drawing 1 is a schematic diagram of the system for providing with road map information, traffic information, etc. the vehicles by which a mounted data communication unit is carried. This system is provided with the following.
The wireless base station 1 installed in the service area of a cellular phone.
PHS base station 2 installed in the service area of PHS (Personal Handy-phone System).
Communications satellite 6.
The information center 4 connected to the wireless base station 1 and PHS base station 2 via the telephone line 3.
The wireless base station 1 and PHS base station 2 are installed for every prescribed area, respectively.
[0013]In the information center 4, traffic information and information, including a weather report etc., including road map information, congestion information, an accident and construction information, road regulation information, etc. are memorized, for example. Road map information divides a road map (a national expressway, a driveway, its foreign country way, a prefectural road, the municipal road of a designated city, and other community roads are included) into mesh state, and is memorized by each mesh unit. The node which is a coordinates position for road map information to pinpoint the crossing and folding point of a road if it explains more concretely, And it comprises a link unit which is the vector which connected the node and the node, and memorizes as data of the coordinates of the beginning point node of each link, and a terminal node, the link number of each link, etc. For example, traffic information is memorized as data of the link number equivalent to the road which has been the target of traffic congestion or regulation, etc.
[0014]The information center 4 transmits road map information, traffic information, etc. near [this] the current position towards the vehicles 5 via the same circuit, when the present position data of the vehicles 5 is received via a cellular-phone circuit, a PHS telephone line, or a satellite communication line from the vehicles 5. Drawing 2 is the block diagram which was carried in the vehicles 5 shown in drawing 1 and in which showing the electric constitution of the mounted data communication unit 10 for transmitting and receiving various data between the information centers 4 (refer to drawing 1).
[0015]GPS receiver 11 for receiving the signal from a GPS (Global Positioning System) satellite is connected to the mounted data communication unit 10, and the signal received by GPS receiver 11 is given to the position detector 12. The position detector 12 computes the current position of the vehicles 5 based on the signal inputted from GPS receiver 11. Specifically based on the travelling period difference of the sending signal of two or more GPS Satellites, the current position of the vehicles 5 is computed. Calculation of the current position of these vehicles is repeated with a constant period (every [for example,] second).
[0016]The output of the azimuth sensor and speed sensor which detect the azimuth variation of the vehicles 5 may be given to the position detector 12 instead of said GPS receiver 11, and the current position of the vehicles 5 may be detected based on these outputs. If it explains concretely, while the advancing azimuth of the vehicles 5 will be called for based on the output of an azimuth sensor, the current position of the vehicles 5 is computed by the mileage of vehicles being found based on the output of a speed sensor, and the advancing azimuth and mileage of the vehicles 5 being accumulated by the initial position of the vehicles 5 set up beforehand. In this case, map matching is performed using the road map data for current position detection memorized by CD-ROM14.
[0017]The present position data computed as mentioned above is given to CPU13. CPU13 functions as a control

center of this mounted data communication unit 10. The display 16 is further connected to CPU13 via the display control part 15. Once information, including the variety of information received by the mounted data communication unit 10, for example, road map information, traffic information, a weather report, etc., is stored in a predetermined memory by CPU13, it is read and is given to the display control part 15. As a result, the contents of the information concerned are displayed on the display 16. If the present position data of the vehicles 5 inputted into CPU13 from the position detector 12 is given to the display control part 15, a road map will be overlapped on the current position of the vehicles 5, and it will be displayed on it.

[0018]The mounted data communication unit 10 is provided with the following.

The portable telephone 22 for communicating via a cellular-phone circuit between the information centers 4 (refer to drawing 1).

The PHS machine 23 for communicating via a PHS circuit between the information centers 4.

The satellite-terminals machine 26 for communicating via a communications satellite circuit between the information centers 4.

The communications line switch controller 21 for switching the communication line to be used to a cellular-phone circuit, a PHS circuit, or a satellite communication line.

[0019]The communications line switch controller 21 is connected to CPU13 via the lines 24 and 25. The line 24 is for transmitting various data between CPU13 and the communications line switch controller 21, and road map information, traffic information, etc. which are transmitted from the information center 4 (refer to drawing 1) are given to CPU13 via the line 24. The present position data computed by the position detector 12 is given to the communications line switch controller 21 via the line 24.

[0020]CD-ROM14 holds the data of an area map, and account data with road map data. The data of the area map was made to correspond to the number of an existence area (mesh), and has memorized the usable means of communication. For example, if three means of communication, the cellular-phone circuit A, the PHS circuit B, and the satellite communication line C, are assumed as shown in Table 1, the usable means of communication A, B, or C will be memorized for every mesh. When usable in two or more means of communication, two or more signs are memorized.

[0021]

[Table 1]

存在地域 (メッシュ番号)	通信手段
001	A, B, C
002	B, C
003	A, C
004	C
⋮	⋮

[0022]Based on the present position data computed by the position detector 12, CPU13 specifies the mesh number of a map, searches the data (refer to Table 1) of an area map, and gets to know an usable means of communication. When an usable means of communication is only, the means of communication is used. When there are two or more usable means of communication, CPU13, The communication line selection signal for directing whether to perform communication with the information center 4 by which circuit based on the account data currently held CD-ROM14 is created, and this communication line selection signal is given to the communications line switch controller 21 via the line 25.

[0023]For example, both three, a cellular-phone circuit, a PHS circuit, and a satellite communication line, presuppose that it is usable and the data volume which receives transmission from the information center 4 is 18 K bytes (144k bit). Since the time which communication takes since transmission speed is 9600 bps is 15 seconds and 2 yen per second when using a cellular-phone circuit, expense changes to 30 yen. Since the time which communication takes since transmission speed is 32k bps when using a PHS circuit is added in 4.5 seconds and a fee is added by a minute unit, as for expense, 40 yen of the minimum charge are needed. 1440 yen is needed when a satellite communication line is used. CPU13 calculates these fees and generates the communication line selection signal of the purport that a cellular-phone circuit is used among a cellular-phone

circuit, a PHS circuit, and a satellite communication line at the time of a communication start.
[0024]When the data volume which receives transmission, such as road map data, is as big as 240 K bytes (1920k bit) and it uses a cellular-phone circuit, it changes to 400 yen, and 40 yen is needed when using a PHS circuit. 19200 yen is needed when a satellite communication line is used. CPU13 calculates these fees and generates the communication line selection signal of the purport that a PHS circuit is used among a cellular-phone circuit, a PHS circuit, and a satellite communication line at the time of a communication start.
[0025]Thus, it is one of the features of this invention to choose the communication line connected to the information center 4 according to the data volume which receives the current position of vehicles and transmission. Drawing 3 is a flow chart which shows the flow of the control action of CPU13. Below, according to the flow of the flow chart shown in drawing 3, the control action of CPU13 is explained in detail.
[0026]If the vehicles 5 carry out a run start, CPU13 will acquire the current position of the vehicles 5 computed based on the signal from the GPS Satellite received by GPS receiver 11 from the position detector 12 (Step S1). Calculation of the current position is performed with the constant period, and CPU13 always holds the newest present position data. Next, it is judged whether CPU13 has the demand which communicates with the information center 4 using a telephone line (Step S2). This demand is made when the information-requirements key automatically illustrated by neither the driver nor a fellow passenger is operated. In starting the information center 4 and communication, it moves to Step S3 and specifies an usable means of communication with reference to the data (Table 1) of the area map memorized by CD-ROM14 (step S4). According to the embodiment of this invention, since a prospect is possible for a communications satellite as a principle no matter vehicles may run what area, the minimum and a satellite communication line shall be secured as an usable means of communication.
[0027]CPU13 judges ******** [the number of usable means of communication / one] (Step S5). If it is one, since there is no room of selection of a means of communication, it will progress to Step S8. If there are more than one, it will progress to Step S6 and the data volume of the data which it tries to receive from the information center 4 will be presumed. Although what kind of method it may be sufficient as this estimation method, when receiving a road map, it receives what byte and traffic information simply and it receives what byte and a weather report, it may be fixed from the start according to what byte and the kind of information.
[0028]And easy calculation is performed with reference to the account data memorized by CD-ROM14, and the means of communication of the cheapest fee is determined (Step S7). The example of this deciding method is as having already explained. If connected with the information center 4 via the determined communication line (Step S8), present position data and the command of the vehicles 5 will be turned to the information center 4, and will be transmitted (step S9). In the information center 4 side, reception of the present position data etc. which were transmitted from the vehicles 5 will return the road map information near the current position of the vehicles 5, traffic information, weather report information, etc. through the communication line connected now.
[0029]Reception of the road map information etc. which are returned from the information center 4 will store the received information (Step S11). (Step S10) If all the information transmitted from the information center 4 is stored (Step S12), Ending communication with the information center 4 (Step S13) CPU13 reads the road map information etc. which are stored one by one, controls the display control part 15 further, and displays the contents on the display 16 (Step S14). Therefore, to compensate for movement of the vehicles 5, a road map etc. can be displayed on the display 16, and also the newest traffic information etc. can always be displayed. When a communication line is disrupted in the middle of communication, it is made to be carried out in processing from Step S1 again.
[0030]As mentioned above, since it has two or more means of communication, the current position of the vehicles 5 when receiving offer of information from the information center 4 is detected and an available communication line is chosen, the area which can communicate can be extended. Since the cheapest means of communication of a fee can be determined when two or more means of communication are available, the expense which data communications take decreases. thus, various data is trustworthy -- and -- cheap -- it can carry out .
[0031]Although the mounted data communication unit concerning this invention is a navigation device and the case where road map information, traffic information, etc. were acquired was explained by explanation of the embodiment of an above-mentioned invention, For example, it may apply to a portable personal computer or a facsimile machine, and personal computer data communications, facsimile communication, etc. may be performed within vehicles. If the case where personal computer data communications are carried out is explained, in this case, a personal computer will hold the data of an area map, and account data, and will incorporate the position detection signal of vehicles from a navigation device etc. And based on the current position of vehicles, a personal computer looks for the candidate of an usable means of communication, and determines the means of communication which can do communication most cheaply. A mounted data communication unit gives the data

received from the information center 4 to a personal computer while it receives the data which should be transmitted to the vehicles exterior from a personal computer using the determined means of communication and transmits to the information center 4.

[0032]Although explanation of the embodiment of this invention is as above, this invention is not limited to an above-mentioned embodiment. For example, although it supposes that a cellular-phone circuit, a PHS circuit, and a satellite communication line are used in explanation of each above-mentioned embodiment, of course, a car telephone circuit can be used. In addition, it is possible to perform various change in the range of this invention.

[0033]

[Effect of the Invention]According to the invention according to claim 1, since what makes the area concerned a communication feasible region among two or more means of communication is chosen by the selecting means according to the position of the detected vehicles while moving in a certain area, always stable communication can be carried out. According to the invention according to claim 2, when it is going to carry out data communications among two or more means of communication, it can communicate by using a means of communication with the cheapest fee.